Zbl 1080.01001

Russo, Lucio

The forgotten revolution or the rebirth of ancient science. Transl. from the Italian by Giangiacomo Feltrinelli. (Die vergessene Revolution oder die Wiedergeburt des antiken Wissens.) (German)

Berlin: Springer. ix, 545 p. EUR 29.95; sFr. 49.80 (2005).

This volume is a German translation of the second Italian edition of the same work (Zbl 0913.01006), updated in agreement with the revisions made in the English translation. Concerning the factual information about the themes treated in the volume, the present reviewer shall abstain from repeating the original review, but he shall add that the writing is pleasant no wonder that the book was nominated for a literary prize in 1997. However, he considers as a definite understatement the words of the first reviewer, that the "theses are formulated in too extreme a way and in details that are unacceptable". Evidently, a similar harsh judgment needs substantiation.

It is certainly true that the first half of the Hellenistic age (the period 300 BCE to 150 BCE) produced scientific insights quite different from most of those we know from pre-Hellenistic Greece, and that it was much more creative in the sciences than the ensuing centuries of Antiquity (even though the exceptions are somewhat more conspicuous than admitted by Russo); moreover, that technological application of scientific insights was strived after in the same period, also largely in contrast to the previous and ensuing periods. It is also true that few original sources have survived from the critical 150 years, which forces everybody interested in the period to rely on and squeeze later accounts and fragments. So far, Russo makes very good points – not all of them quite new, but earlier proponents of similar views have not had the impact they deserved.

When we go beyond this, things become problematic. Firstly, in order to argue for the existence of a *scientific revolution*, a revolution of which that of the early Modern period should be nothing but a repetition or even a rediscovery, Russo has to build on a very simplistic image of what a science is and of how scientific knowledge serves technical application. As italicized on p. 21, a scientific "theory has a strictly deductive structure", consisting of axioms or postulates and theorems derived from them, and it goes together with a set of correspondence rules, which allow direct application within a specific range of reality (neither fitting nor feedback being needed). "Empirical sciences" like chemistry need to take actual properties of the world into account, but this is a secondary aspect. The view of contemporary science is also quite naive. P. 24 we read that Archimedes' doctrine "allows the resolution of almost the same problems as modern statics" – one wonders whether that includes the bending of non-isotropic materials under strain, and how Russo will read tensor calculus (or just the differential calculus needed to calculate the bending of a rectangular beam under its own weight, or Hooke's law) from Archimedes' treatises. On p. 31, Archimedes' doctrines are claimed to constitute dynamics, because the machines serve to move things; Russo apparently has not understood that Modern dynamics investigates ongoing movement, not only the resulting displacement, and therefore has to involve acceleration, duration etc.

In the detailed argument, things become even more questionable. Quite often, later witnesses are claimed not to understand what they relate about the early Hellenistic workers, which may in many cases be true (why, for instance, should Plutarch know Archimedes' private thought?); but the "right" interpretation proposed by Russo according to his thesis is rarely as certain as he claims (why should Russo know it?).

Regularly, inconvenient sources are forgotten, or they are misrepresented so as to fit. On the first account, the arguments for the absolute novelty of Euclid's *Elements* may serve as an example. The mathematics of the fourth century is represented (p. 57) by a few references to Plato and by Aristotle's exemplification of principles that are specific to one science by the model definitions "a line is such and such, and straight so

and so" (An. Post. 76a40, transl. J. Barnes, *Complete Works of Aristotle* I, Princeton 1984); Russo (or the translator) cuts the quotation down to the meaningless "daß eine Linie von der und der Art ist, und das Gerade" ["that a line is such and such, and the straight"] and concludes that such principles allow no demonstrations of theorems; all Aristotle's specific references in other places to definitions and proofs are neglected, including the explicit citation of Postulate 2 in *Physics* 207b20–31, "[mathematicians] postulate only that a finite straight line may be produced as far as they wish" (transl. Barnes). Ignorance of this single passage is understandable, but total ignorance of the numerous other passages where geometrical definitions or proofs are spoken of is at least odd. It is even more odd that Hippocrates of Chios is not mentioned anywhere in the book, although his writing of the earliest book of *elements* is well known, and that the whole sequence of supposed fourth-century contributors to the *elements* mentioned by Eudemus is equally ignored, even though Russo has read Eudemus (as quoted by Proclus) well enough to censure him (p. 40).
Misrepresentation of sources may be exemplified by the claim (p. 230) that Apollonius must have been interested in the practical utility of his mathematics, since he promises in the preface to *Conics* VII that Book VIII (now lost) will contain propositions that are applicable to "many problems". Unfortunately, as Apollonius adds within the same sentence, "particularly to the diorisms of these problems" – which shows that Apollonius speaks of mathematical, not technical problems. Since Russo appears to have used Apollonius' own text, it is hard to believe that this is a mere honest lapse.
Other errors may be due to honest lack of basic technical experience (unexpected in a former teacher of rational mechanics?). P. 113, Heron's *baroulkós* is presented. It is understood as an instance of real technology and of the "scientific" calculation of the efficiency of a mechanism consisting of five interacting cogs; the machine may be real, but reading of the text in *Opera omnia* II shows that Heron's calculation is a purely mathematical example: a "man or boy" is supposed to be able to lift 5 talents (c. 125 kg) without the machine, and the machine is perfect, without the least friction even when loaded with 25 metric tons ($\frac{1}{2}$ kg added to the situation of equilibrium will make the machine run). Hellenistic technicians (some of them also "scientists") probably performed things that had never been achieved before in military and civil engineering; but if they did, they must have had a profound grasp of how to minimize friction, bending and the risk of breaking (etc.) – none of which was "scientifically" understood at the times in Russo's sense (a fact that makes the engineering feats even more astounding).
Sometimes, familiar chronology is disregarded. On p. 230 the trisection of the angle is thus believed to have been originally a practical problem derived from trigonometry; quite apart from the difficulty of achieving the necessary numerical accuracy when drawing with a stylus on a dust abacus (or on papyrus), Russo forgets that the concern with this problem antedates Hipparchus' trigonometry by centuries (*T. Heath*'s proposal that it came from interest in theoretically exact construction of regular polygons is much more plausible – *History of Greek Mathematics* I, p. 235, Oxford (1921; JFM 48.0046.01)).
When it comes to the understanding of what had been done and known in Egypt and Babylonia, Russo is blissfully ignorant (speaking none the less with apodictic certainty); when best, he builds for such questions on *O. Neugebauer*'s *Exact Sciences in Antiquity* (1952; Zbl 0049.00201), misreading however this (excellent but somewhat dated) popularization.
Let these examples from the scores and scores of protests and question marks in the margin of the reviewer's copy suffice. In conclusion: historians of science may learn much from the book which they did not know, but they should read carefully in order to be sure that the conclusions follow from the evidence and not from circular reasoning; they should also check in original the sources and the authorities that are used. Innocent readers should be aware that part of the attractive fable *is* a fable, and the extent of its veracity undetermined.

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∗01A20 Greek or Roman mathematics
01-02 Research monographs (history)
01A40 Mathematics in the 15th and 16th centuries, Renaissance
01A45 Mathematics in the 17th century